

CAMERA HAVING LIGHT INTERCEPTING MEANS

The present invention relates to a camera having a light intercepting means which prevents harmful light from entering a ^{camera body} lens barrel through an annular gap between a lens barrel which moves in an optical axis direction and a lens holding cylinder which slidably supports the lens barrel.

In a conventional lens shutter type of compact camera having a range finder, a focal length of the photographing lens is not usually variable. However, recently, this range finder type of compact camera has been developed to have an autofocus function and a zoom lens as a photographic lens.

In this zoom compact camera, a lens barrel is advanced from the camera body during the zooming operation to move in the optical axis direction.

To smoothly advance the lens barrel from the camera body, a slight gap must be provided between the outer periphery of the lens barrel and a lens holding member which is provided on the camera body to movably support the lens barrel. Accordingly, there is a possibility that light enters into the camera body through the gap between the outer periphery of the lens barrel and the lens holding member, thus resulting in undesired exposure of a film in a film chamber. To prevent such an undesirable exposure by harmful light, a light intercepting apparatus as shown in Fig. 5 or Fig. 6 is usually provided.

In Fig. 5, a lens holding member (cylinder) 2 has a center bore 2A in which a lens barrel 1 is movably inserted and which has an inner diameter having a predetermined tolerance with respect to the outer diameter of the lens barrel 1. A flock paper 4 having a predetermined width is adhered to the inner periphery 2B at the front end of the center bore 2A of the lens holding cylinder 2 so that the inner surface of the flock paper 4 comes into slide

contact with the outer periphery of the lens barrel 1 to intercept harmful light which would otherwise enter the camera between the gap between the inner peripheral surface of the lens holding cylinder 2 and the outer peripheral surface of the lens barrel 1.

In an arrangement illustrated in Fig. 6, an annular light intercepting tongue 5 which is made of an elastic material, such as rubber or resin film or the like, is provided on the front end 2C of the lens holding member 2, in addition to the flock paper 4 shown in Fig. 5. The light intercepting tongue 5 has an inner diameter which is slightly smaller than the outer diameter of the lens barrel 1. The annular light intercepting tongue 5 is deformed to increase the inner diameter thereof when the lens barrel 1 is fitted in the annular light intercepting tongue 5 so that the inner peripheral surface of the annular light intercepting tongue 5 comes into close contact at the front end thereof with the outer peripheral surface of the lens barrel 1 to intercept harmful light. The direction of the front end of the annular light intercepting tongue 5 is reversible in accordance with the axial movement of the lens barrel 1 in opposite directions. Numerals 3 and 21 in Figs. 5 and 6 respectively designate an outer shell and a cam ring which actuates the lens barrel 1 to advance while rotating.

In the above mentioned conventional structures, however, the flock paper 4 hardly deforms in the direction of the thickness thereof, and accordingly, a possible dimensional error or a displacement in the direction of the thickness can not be effectively absorbed. Namely, possible "out of roundness" and "out of concentricity" of the lens barrel 1 and the center bore 2A of the lens holding member 2 can not be effectively absorbed by the flock paper 4. As a result, a slight gap which allows harmful light to enter from outside of the lens barrel 1 may exist between the lens barrel 1 and the lens holding member 2.

Furthermore, in the arrangement shown in Fig. 6 in which the light intercepting tongue 5 is additionally provided, a set screw 7 is usually used

to secure some member to the lens barrel 1. The lens barrel has a recess 1A in which the head 7A of the set screw 7 is received. In this case, there is a large possibility that harmful light enters through the recess 1A as shown by an arrow in Fig. 6.

An object of the present invention is to provide a light intercepting apparatus which can effectively intercept a harmful light, regardless of possible "out of roundness" and "out of concentricity" of the lens barrel and the center bore of the lens holding member and even if there is a bored recess on the outer surface of the lens barrel to receive the head of a set screw.

According to the present invention there is provided a camera comprising a lens holding member for slidably supporting a lens barrel to move in an optical axis direction;

and a pair of light intercepting rings provided on the lens holding member, each having a flexible radially inner edge defining a center opening of a diameter smaller than the outer diameter of the lens barrel whereby the ~~center openings~~ ^{said radially inner edges} are deformed in opposite directions to contact with the outer peripheral surface of the lens barrel.

Preferably, said radially inner edges are deformed enough to prevent the directions of the deformation from being reversed in accordance with the sliding movement of the lens barrel.

Conveniently, said light intercepting rings are symmetrically opposed to each other and located side by side so that the inner ~~ends~~ ^{edges} thereof do not interfere with each other.

Each of the light intercepting ring may comprise a flexible body ring and a reinforcing ring adhered to the flexible body ring.

In this case, said reinforcing ring has an inner diameter larger than the center opening of the associated flexible body ring.

In a preferred embodiment, the camera further comprises an annular flock paper located to the interior of said light intercepting rings and between the outer periphery of the lens barrel and the inner periphery of the lens holding member.

In one case, said lens barrel is provided on its outer peripheral surface with a recess.

Consequently, the deformation of the radially inner edges of the light intercepting rings can encompass the width of said recess.

Conveniently, the camera further comprises an outer shell provided

outside the lens holding member.

In this case, said light intercepting rings are held between and connected to the front end face of the lens holding member and said outer shell.

Preferably, said flexible radially inner edges are made of synthetic resin.

An example of the present invention will be described below in detail with reference to the accompanying drawings, in which:-

Figure 1 is a partial sectional view of a light intercepting means of a camera embodying the present invention;

Fig. 2A is a perspective view of the light intercepting means shown in Fig. 1;

Fig. 2B is an exploded perspective view of the light intercepting means shown in Fig. 2A;

Figs. 3A through 3C are partial sectional views of the light intercepting means shown in different operational positions, in accordance with the axial movement of the lens barrel;

Fig. 4 is a partial sectional view of the light intercepting means shown in an eccentric position of the lens barrel;

Figs. 5 and 6 are sectional views of two known light intercepting apparatus.

In a camera illustrated in Fig. 1, a lens holding member 2 has a center bore 2A in which a lens barrel 1 is inserted so as to move in the optical axis direction. Numerals 3 and 21 respectively designate an outer shell and a

cam ring which actuates the lens barrel 1 to advance while rotating.

The center bore 2A of the lens holding member 2 has at its front end a larger diameter portion 2B having a predetermined axial length. An annular flock paper 4 is applied to the inner periphery of the larger diameter portion 2B so that the flock paper 4 comes into contact with the outer periphery of the lens barrel 1 to intercept light.

To a front end 2C of the lens holding member 2 are adhered a pair of light intercepting rings 10, 10 which are side by side.

Each of the light intercepting rings 10 has a flexible body ring 11 and a reinforcing metal plate ring (hard ring) 12 which is superimposed on and adhered to one side of the flexible body ring 11 by an adhesive 13. The flexible body ring 11 is made of a synthetic resin (resin film or sheet) having a light intercepting property and which has predetermined inner and outer diameters. The reinforcing metal plate ring 12 has an outer diameter almost the same as that of the body ring 11 and an inner diameter larger than that of the body ring 11 by a predetermined value, as can be seen in Figs. 2A and 2B.

The inner diameter of a center opening 11a of the body ring 11 is smaller than the outer diameter of the lens barrel 1 by a predetermined value so that when the lens barrel 1 is fitted in the light intercepting rings 10, the radially inner edges of the body rings 11 are elastically deformed into a conical shape. The amount of deformation, i.e. the axial length of the deformed inner edges of the body rings 11 extending along and on the outer periphery of the lens barrel 1 is such that no reverse in the direction of extension of the deformed inner edges occurs due to the reciprocal axial movement of the lens barrel 1.

Alternatively, it is also possible to provide body rings 11, each having conical inner openings in their free state as viewed in a longitudinal section. In this alternative, the inner edges of the body rings

11 deform and come into elastic contact with the outer periphery of the lens barrel 1.

A pair of light intercepting rings 10 which are superimposed one on another and interconnected are secured to and between the front face 2c of the lens holding member 2 and the outer shell 3, so that the body rings 11 are coaxial to the center bore 2A of the lens holding member 2 in a symmetrical arrangement in which the body rings 11 are symmetrically opposed to each other.

The lens barrel 1 is inserted and fitted in the light intercepting rings 10 by elastically deforming the body rings 11 into a conical shape, as mentioned above. The direction of the deformation, i.e. the directions of elongation of the radially inner edges of the body rings 11 of the two light intercepting rings 10 are opposite to each other, as can be seen in Figs. 3A through 3C, so that no interference between the deformed inner ends occurs.

In the case where there is a bored recess 1A in which a head 7A of a set screw 7 can be received on the outer periphery of the lens barrel 1, the total length (effective seal length) "W" of the deformed inner ends of the body rings 11 must be longer than the axial length "d" of the bored recess 1A, as shown in Fig. 1.

Because of the above-mentioned relationship of $d < W$, at least one of the radially inner edges of the body rings 11 of the two light intercepting rings 10 is always in contact with the outer peripheral surface of the lens barrel 1, regardless of the axial displacement of the lens barrel 1 so that one of the contact portions can prevent harmful light from entering the camera to expose a film (not shown), as shown in Figs. 3A through 3C.

Note that the radially inner edge of the body ring 11 of the front light intercepting ring 10 (left light intercepting ring in Fig. 1) does not protrude outside the front end of the outer shell 3. This is to avoid the bad appearance of the radially inner edge of the body ring 11 being exposed and to eliminate the possibility of the radially inner edge of the body ring 11

being damaged.

Even when the lens barrel 1 reciprocally moves (slides) in the optical axis direction, no direction change in the deformed state of the radially inner edges of the body rings 11 of the light intercepting rings 10 takes place. Namely, the radially inner edges of the body rings 11 are always kept in contact with the outer peripheral surface of the lens barrel 1 to effectively intercept harmful light.

In the case where there is "out of roundness" and/or "out of concentricity (i.e eccentricity)" of the lens barrel 1 and the lens holding member 2, which may be caused even after assembly when an external force is applied thereto, the deformed radially inner edges of the body rings 11 deform or are restored to absorb the "out of roundness" and/or "eccentricity" as shown in Fig. 4, thereby to maintain the close contact of at least one of the inner edges of the body rings 11 with the outer peripheral surface of the lens barrel 1.

Finally, it should be also appreciated that since the light intercepting means can be realized by thin light intercepting rings (plates), no additional space for providing the light intercepting apparatus is substantially needed, thus resulting in the realization of a compact and light camera.



CLAIMS

1. A camera comprising a lens holding member for slidably supporting a lens barrel to move in an optical axis direction;
and a pair of light intercepting rings provided on the lens holding member, each having a flexible radially inner edge defining a center opening of a diameter smaller than the outer diameter of the lens barrel whereby the ~~center openings~~ ^{said radially inner edges} are deformed in opposite directions to contact with the outer peripheral surface of the lens barrel.
2. A camera according to claim 1, wherein said radially inner edges are deformed enough to prevent the directions of the deformation from being reversed in accordance with the sliding movement of the lens barrel.
3. A camera according to claim 1 or 2, wherein the light intercepting rings are symmetrically opposed to each other and located side by side so that the inner ~~ends~~ ^{edges} thereof do not interfere with each other.
4. A camera according to any preceding claim, wherein each of the light intercepting rings comprises a flexible body ring and a reinforcing ring adhered to the flexible body ring.
5. A camera according to claim 4, wherein said reinforcing ring has an inner diameter larger than the center opening of the associated flexible body ring.
6. A camera according to any preceding claim, further comprising an annular flock paper located to the interior of said light intercepting rings



and between the outer periphery of the lens barrel and the inner periphery of the lens holding member.

7. A camera according to any preceding claim, wherein said lens barrel is provided on its outer peripheral surface with a recess.

8. A camera according to claim 8, wherein the deformation of the radially inner edges of the light intercepting rings can encompass the width of said recess.

9. A camera according to any preceding claim, further comprising an outer shell provided outside the lens holding member.

10. A camera according to claim 9, wherein said light intercepting rings are held between and connected to the front end face of the lens holding member and said outer shell.

11. A camera according to any preceding claim, wherein said flexible radially inner edges are made of synthetic resin.

12. A camera substantially as hereinbefore described with reference to Figures 1 to 4 of the accompanying drawings.
